5.0 FIELD METHODS AND PROCEDURES

Specific methods and procedures followed during field activities at the WCP East Grand Avenue WQARF Site were detailed in the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) prepared for this project (WESTON, 2001a and 1999) including the following.

- Hollow-stem auger/mud rotary drilling procedures.
- Lithologic logging procedures.
- Geophysical logging procedures.
- Monitor well installation, development, surveying, and low-flow purging procedures.
- Water level measurement procedures.
- Sample collection procedures and equipment, including borehole soil sample collection, non-discrete soil sample collection, Hydropunch® groundwater sample collection, and groundwater monitor well sample collection.
- Field quality control samples (field blanks, trip blanks, and field duplicates) including sample frequency.
- Sample handling and shipping procedures.
- Field documentation procedures including field logbook and field form requirements.
- Equipment decontamination procedures.
- Investigation derived waste handling and disposal procedures.

The following sections describe deviations from or additions to the written project plans.

5.1 MONITOR WELL COMPLETION

Completion of the monitor wells involved the installation of blank and slotted casing, filter pack materials, and annular well sealing materials. Monitor wells were constructed in accordance with ADWR's Well Construction and Driller's Rules, Arizona Administrative Code, Article 8 as specified in the FSP. The specifications for the monitor well completions are presented in Table 5-1. Well completion diagrams for each well installed by WESTON are presented in Appendix E.

Boreholes converted into shallow monitor wells were drilled with a nominal 11-inch diameter to approximately 30 feet below the estimated SWL. The total depth (TD) of the monitor well borings ranged from approximately 139.5 to 155 feet bgs.

The deep monitor well borehole was drilled in a nominal 10-inch borehole to a depth of 300 feet bgs and completed to a depth of 246 feet bgs. Groundwater samples were collected using a Hydropunch® sampler upon encountering the groundwater zone, at approximately 30-foot depth increments to the total depth of the borehole. Groundwater samples collected during drilling were analyzed for VOCs using EPA Method 8260B. The screened interval and the total depth of the deep well was based on the Hydropunch® laboratory analytical results and the geophysical data.

5.2 AQUIFER TEST PROCEDURES

An Aquifer Test Proposal was submitted to ADEQ after completion of the Phase IV well installations (WESTON, 2001b). The proposal recommended performing step drawdown and aquifer pumping tests at monitor wells WCP-28 and WCP-29 and detailed the proposed test methodology. The aquifer tests included two step tests and one 21.5-hour constant rate pumping test.

Data derived from the aquifer test were evaluated following completion of the test. The data were analyzed in accordance with accepted analytical methods to evaluate aquifer parameters such as hydraulic conductivity, transmissivity, and storage coefficient. Results of the aquifer test data analyses are discussed in Section 2.7.3. The complete aquifer test procedures and analysis techniques are documented in Appendix C of this report.

5.3 MONITOR WELL SAMPLING

Groundwater samples were collected during 15 sampling events during the course of the RI. Groundwater samples were collected beginning with the least contaminated wells and progressing to wells with higher concentrations of suspected contamination.

The first sampling event was conducted in December 1999. The samples were collected using a bailer after low-flow purging was completed using a submersible pump. During the following two sampling rounds, groundwater samples were collected directly from the pump discharge in addition to using the bailer method.

Round 2 sampling was conducted in January and February 2000. Each well was sampled directly from the pump and six monitor wells on or near the VW&R facility (WCP-15, WCP-16, WCP-17, WCP-28, WCP-29, and WCP-30) were also sampled using the bailer method upon removal of the submersible pump. Groundwater sampling during Round 3, conducted in March 2000, used both sampling methods for each monitor well sampled. Groundwater samples were collected directly from the pump in subsequent groundwater sampling events.

The purge method was changed during Round 10 so three casing volumes were removed at higher flow rates compared with the low-flow techniques typically used. This round was conducted immediately following Round 9 in order to compare analytical results from samples collected using different purge methods. The three casing volume method was also used during Rounds 13 through 15. A discussion of different sample and purge methods is presented in Section 7.5.2.1 and 7.5.2.2.

The depth of the intake of the submersible pump used to purge and collect samples changed over the course of the project. Initially, the pump intakes were placed in a permeable zone based on lithologic logs, or at 5 to 10 feet above the bottom of the well. The pump intake for WCP-15, WCP-16, and WCP-17 was placed approximately 2 to 3 feet above the bottom of the well.

Beginning with groundwater sampling Round 7, the first round after installing the Phase IV monitor wells, the pump intake was set at 5 feet below the measured water level for the new wells (WCP-47, WCP-83, WCP-84, WCP-85, WCP-86, WCP-87, WCP-88, WCP-89, and WCP-90). The pump placements for the remaining wells in the sampling network were set at the depths mentioned above.

The pump intake setting depths were standardized at 5 feet below the measured water level beginning with Round 8. In wells where the water column is less than 5 feet, the pump intake

was placed approximately 1 foot off the bottom of the well. The only time the pump settings have been different for subsequent rounds occurred during Rounds 10, 13, 14, and 15. The pump intake settings for these sampling rounds was 10 feet below the water table in order to allow for greater drawdowns associated with the higher flow rates used during the three well purge prior to sampling.

The following sections describe the procedures followed for each purge and sample method.

5.3.1 Monitor Well Purging Methods

Prior to groundwater sample collection, depth-to-water measurements were taken and then all monitor wells were purged either by the low-flow purge method or by removing three casing volumes of purge water. The low-flow purge method was described in the FSP. The three casing volume purge method is described below.

5.3.1.1 Three Casing Volume Purge Method

The following procedures were followed during the three casing volume purge process.

- Same as Step 1 of the low-flow method.
- Same as Step 2 of the low-flow method.
- Same as Step 3 of the low-flow method.
- A stainless steel submersible pump was placed 10 feet below the initial SWL, unless the well had a water column less than 10 feet deep. If the water column in the well was less than 10 feet, the pump was set approximately 1 inch off the bottom of the well.
- The pumping rate was set at the lowest sustainable rate possible.
- Groundwater quality parameters were monitored as described in Step 6 of the low-flow method.
- The sample was collected after a minimum of three well casing volumes had been removed from the well, or after the groundwater parameters from Step 6 stabilized within the specified ranges over three consecutive readings.

If a monitor well was pumped dry prior to removing three well casing volumes, the well was allowed to recover for approximately 20 minutes before pumping resumed. If the well was pumped dry a second time, before the three well casing volumes had been removed and/or before

the groundwater parameters had stabilized, the pump was pulled from the well. The well was allowed to recover to approximately 80 percent of the original SWL and a groundwater sample was then collected using a disposable bailer.

5.3.2 Passive Diffusion Bag Sample Collection Method

During Round 12 of groundwater sampling, samples from nine wells (WCP-16, WCP-17, WCP-28, WCP-29, WCP-85, WCP-87, WCP-88, WCP-93, and WCP-94) were collected using PDB samplers. Samples from these wells were also collected following the low-flow purge method and pump discharge collection methods described in the FSP.

Each well was outfitted with two PDB samplers, excluding WCP-16 and WCP-17, which did not have a sufficient water column for two samplers. PDB samplers were installed 2 feet beneath the groundwater surface in each of the nine wells. The second PDB sampler in the remaining wells was installed opposite a permeable zone near the bottom of the well. Protective mesh covers for the sampler bags were not used because the sampler was installed in a cased monitor well. The installation of the samplers and sample collection are described below.

Installation

- The line was unwrapped until the first sampler location was reached. Wing nut clamps were attached to ¼-inch diameter holes in the tabs at the top of the PDB sampler, using the stainless steel snap ring or plastic cable ties.
- The line was further unwrapped to the desired location of the second sampler and the bag was attached as described above. When only one PDB sampler was placed in the monitoring well, the bottom of the sampler was attached to the line using a cable tie.
- After the final sampler bag was attached to the line, the top end of the line was attached to the well cap so the sampler bags were located at the desired depth. A plastic disk with a diameter greater than the inside diameter of the monitoring well was added to the top of each line as a safety device to ensure the sampler bags and hardware could not accidentally be lost down the well.

Recovery

- The samplers remained in the wells for 14 days after installation to allow for full equilibration prior to recovery.

- The sampler was removed using a plastic reel and then dried using a clean paper towel.
- Within one hour of removing the sampler from the monitoring well, the water sample was transferred into 40-mL glass vials. The top tab of the sampler was partially cut below the heat seal and the contents were carefully poured into the glass vials.
- The sample vials were labeled and prepared for shipment to Columbia following standard chain-of-custody protocol.

5.4 INVESTIGATION-DERIVED WASTE HANDLING AND DISPOSAL

IDW generated during the WCP East Grand Avenue WQARF Site RI included: lithologic cuttings/drilling mud from the drilling of soil boring/monitor wells; rinse water from equipment decontamination; purged groundwater from monitor well development, sampling, and aquifer testing; personal protection equipment (PPE); and miscellaneous trash. IDW generated during the investigation was either temporarily stored within the boundaries of the WCP East Grand Avenue WQARF Site or transported to Philip Services Corp (PSC) in Department of Transportation (DOT) approved 55-gallon drums, waste roll-off bins, water wagons, and/or Baker tanks pending receipt of waste characterization analytical results. Waste characterization sampling of IDW was conducted in accordance with the RI FSP prepared by WESTON for the project (WESTON, 2001). IDW generated during this investigation was managed as non-hazardous solid waste. The waste handling procedures followed by WESTON for lithologic cuttings/drilling mud and purged groundwater are discussed in the following sections.

5.4.1 Lithologic Cuttings/Drilling Mud

Lithologic cuttings/drilling mud generated during the RI was contained in DOT approved roll-off bins with inserted plastic liners. WESTON collected composite samples from five locations within the roll-off bins to characterize soil IDW generated during the investigation. All composite samples were collected within the appropriate laboratory supplied sample containers, placed in a cooler with ice, and transported with signed COC documentation to STL.

Composite sample analytical results for waste characterization indicated that cuttings generated during the WCP East Grand Avenue WQARF Site RI were non-hazardous. Upon receipt of the analytical results, PSC completed the necessary waste profile forms for subsequent disposal.

Cuttings generated during the investigation were transported by PSC to Butterfield Solid Waste Landfill for disposal. The liquid associated with the drilling mud was transported to Resource Recovery Techniques of Arizona, Inc. (RRTA) then to Rainbow Valley West of Phoenix, Arizona for land farm application. The signed waste profile forms and transportation manifest prepared by PSC are presented in Appendix F. Analytical results of the IDW samples are included in Appendix G.

5.4.2 Rinse Water/Purged Groundwater

Liquid IDW generated during the WCP East Grand Avenue WQARF Site RI included rinse water from equipment decontamination and purged groundwater from monitor well development, sampling, and aquifer testing. Rinse water generated from the decontamination of drill rig augers was contained in a temporary decontamination pit lined with plastic. The decontamination water that did not evaporate and the plastic liner were transported to a roll-off bin with the residual soil to be disposed of as solid waste with soil cuttings, as discussed in Section 5.4.1. Purged groundwater generated during the investigation was either stored in Baker tanks or transported in a 500-gallon water wagon to be discharged directly to the COP sewer in accordance with the COP discharge permit. WESTON collected a composite sample from each Baker tank and/or water wagon using a disposable bailer. Liquid samples were decanted from the bailer into the appropriate laboratory supplied sample containers, labeled, and placed in a cooler with ice to be transported with COC documentation to STL in Chicago. The analytical results were used along with historical monitor well sample analytical results to obtain sewer discharge permits and manhole entry permits from the COP Water Services Department/Pollution Control Division. WESTON discharged purged groundwater generated during the investigation to City sewer manhole #403, located south of Whitton Avenue on 28th Avenue (Figure 4-1).

Groundwater sample analytical results indicated that purged groundwater generated from monitor wells WCP-44 and ENT-MW-2 contained concentrations of benzene above the Instantaneous Effluent Limitations as outlined in the COP Code, Chapter 28, Section 28-8 of

Article II. Subsequently, purged groundwater generated during the sampling of these monitor wells was contained separately in 55-gallon or 30-gallon drums. The drums were transported to an appropriate facility for disposal.